The Relationship Between Pianists' Perceptions and Spinal Posture Following Alexander Technique Lessons

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Abstract

Studies have shown that musicians feel their posture has improved after studying the Alexander Technique (AT). However, no study has examined if participants' perceptions agree with their quantitatively measured posture. This study explored the relationship between pianists' perceptions of their posture along with their application of the Technique and the measurements taken of their spinal posture. Fifteen pianists completed questionnaires about how they perceived their posture and how they applied AT principles while playing. Their responses were compared with their own postural data collected during a previous study to determine if there were commonalities between pianists' perceptions and their postural changes. Results showed a wide range of responses as to how pianists applied the Technique while playing. Findings also showed that there was not always a clear relationship between participants' perceptions and their postural data. In conclusion, pianists' perceptions do not always agree with direct measures of posture.

Keywords: Alexander Technique; perception; pianists; posture; postural changes.

Résumé

Des études ont montré que les musiciens sentent que leur posture s'est améliorée après avoir étudié la technique Alexander (AT). Cependant, aucune étude n'a examiné si les perceptions des participants concordaient avec leur posture mesurée quantitativement. Cette étude a exploré la relation entre les perceptions des pianistes de leur posture ainsi que leur application de la Technique et les mesures prises de leur posture vertébrale. Quinze pianistes ont rempli des questionnaires concernant la façon dont ils percevaient leur posture et la manière dont ils appliquaient les principes de l'AT tout en jouant. Leurs réponses ont été comparées à leurs propres données posturales recueillies lors d'une étude précédente pour déterminer s'il y avait des points communs entre les perceptions des pianistes et leurs changements posturaux. Les résultats ont montré un large éventail de réponses concernant la manière dont les pianistes appliquaient la Technique tout en jouant. Les résultats ont également montré qu'il n'y avait pas toujours une relation claire entre les perceptions des participants et leurs données posturales. En conclusion, les perceptions des pianistes ne concordent pas toujours avec les mesures directes de la posture.

Mots clés : technique Alexander ; changements posturaux ; perception ; pianistes ; posture.

Introduction

The Alexander Technique (AT) is a somatic method that teaches its students to alter the way they move, to enhance day-to-day activities, including playing a musical instrument (Conable & Conable 1995; Klein, Bayard & Wolf 2014). Students are taught several key principles to help them change their movement patterns through indirect means (i.e., without actively trying to change movement or posture). These principles are primary control, inhibition, direction, habit, and faulty sensory awareness. Students' understanding of how to alter their use of the body are based on these ideas, so these principles will be briefly defined from an AT perspective. Primary control is a "dynamic relationship" between the head, neck, and back that "facilitates movement throughout the body" (Jones 1997, p. 200). Inhibition is "refusing to do anything immediately in response" to a stimulus (Alexander 2001, p. 40). It allows students to stop and think before moving to change their typical movement or posture patterns. Direction is "the process of sending motor commands to influence…muscular activity" (Cacciatore, Horak & Henry 2005, p. 567). Examples of directions are, "Allow the neck to be free," "allow the head to go forward and up," and "allow the back to lengthen and widen." Habit is a person's typical response to a given stimulus (Jones 1997) and faulty sensory awareness is "the unreliability of… the kinaesthesia upon which people base the control and direction of their bodily activities" (Barlow 2005, p. 81). This means that what one perceives about one's body, including its movement and position, may not necessarily be true. Lessons in the AT are given by a certified teacher. Students learn the principles of the Technique through both verbal instruction and hands-on guidance (Barlow 1990). The hands-on guidance consists of the teacher physically manipulating the student, so they receive "sensory experiences" associated with the directions being learned (Maisel 1990).

There are often benefits associated with learning the AT for musicians. Such benefits include developing ease of movement while playing, developing an awareness of excessive tension, improving coordination, reducing discomfort, and improving posture (Ben-Or 1987; Conable & Conable 1995; Kleinman & Buckoke 2013; Rosenthal 1989). Research conducted concerning the AT and musicians have shown that the AT can lead to these outcomes. Anne Cecilie Røsjø Kvammen explored musicians' experiences with the AT. Interviews were held with six professional musicians who had taken AT lessons prior to data collection: a horn player, a trumpet player, a cellist, a double bassist, a violinist, and an oboist. Participants felt that there was "an increased sense of freedom while playing" and were able to play "with greater ease" (Kvammen 2013, p. 55).

Iris Kaplan (1994) interviewed six pianists who had taken lessons in the AT. Findings revealed that pianists felt that the AT increased their awareness of the relationship between the body and the piano, and that the AT provided a way to release tension.

Kristin Jane Mozeiko (2011) examined the effects of the AT on the pain, skill function, awareness, and well-being of violinists and violists, and also described the experiences of those who took AT lessons. Fifty-one violinists and violists participated and were assigned to either the experimental or control group. The experimental group received 20 lessons in the AT. Questionnaires given to the participants

asked them to rate their pain, skill function, awareness, and well-being before and after the intervention period. Semi-structured interviews were held with six participants from the experimental group to discuss their experience with the AT. Findings of this study showed significant differences between the experimental and control groups, with the experimental group demonstrating a greater reduction in pain in comparison with the control group. Within the AT group, awareness and skill function were significantly different from pre-test to post-test. Results from the interviews also demonstrated that most participants felt there was decreased pain and improved skill function, awareness, and well-being.

Patricia Furst Santiago (2004) explored the AT's effect on the performance of young pianists. Twenty students between the ages of 10 and 14 were assigned to an experimental group, which received 8 weeks of 15- to 20-minute lessons in the AT, or to a control group, which received 8 weeks of sessions in mythology. Students were video-recorded before and after the intervention period. These recordings were then watched by six piano teachers, three doctors, and four AT teachers who participated in group discussions about the recordings they viewed. Results showed that the AT appeared to have an effect on posture and tension, although these improvements were also seen in the control group, so the author concluded that it was not possible to attribute these changes to the AT alone.

Janet Davies (2020b) examined the effects of the AT on playing-related pain and its associated risk factors in musicians, as well as its impact on musical performance. A total of 23 music performance students participated in this study including three violinists, three violists, four cellists, two flautists, two clarinettists, eight pianists, and one conducting student. Participants were to attend one AT class per week, for one semester. Post-AT questionnaires asked participants to rate the benefits of the AT on health and wellness outcomes. Participants were also asked about how they felt the AT had impacted their playing-related pain. Results showed that all participants rated the AT as beneficial for reducing pain, improving posture, releasing excessive muscular tension, and improving instrumental technique and performance.

Davies (2020a) also conducted a follow-up study to examine how music students and their teachers perceived their playing performance following lessons in the AT. Twelve music students from the previous study, including two violinists, two violists, three cellists, two clarinettists, and five pianists, as well as eight teachers participated. Video recordings were made of the students' playing before and after the AT program. Students and teachers watched the videos and rated the amount of change they saw for each outcome measure including "posture, excess muscle tension, and instrumental technique" (*ibid.*, p. 197). Results showed that both students and teachers felt that posture had improved, excessive muscular tension had decreased, and movement quality had improved.

Fung Ying Loo and colleagues (2015) examined the effects of AT lessons on muscular tension in pianists. Fifteen undergraduate student piano majors participated in this study, and all received 14 weeks of 3-hour group lessons. Questionnaires were given to participants before and after the intervention period asking them to rate themselves on the amount of tension they experienced in their upper and lower extremities as well as their torsos while playing. Results showed that following AT

training, there was a significant decrease in participants' perceived levels of muscular tension.

Robert James Englehart examined the effect of the AT on neck muscle activity in singers. Twenty-three participants were assigned to an AT group, a Body Awareness group that received sessions in Jacobson's Progressive Relaxation therapy, or a control group that received "standard vocal exercises" (Englehart 1989, p. 81). Each group was given 10 days of group training. Only four participants from each group received electromyographic testing due to time and equipment restrictions. Results showed that participants from the AT group were able to alter upper trapezius muscle activity more than participants from the other groups.

Rachelle C. Wolf and colleagues (2017) studied the effects of a 10-week AT intervention on violinists' and violists' muscle activation and movement kinematics. Four of the seven participants received 1-hour weekly group lessons in the AT, while the other three participants received no lessons. Results showed no trends in electromyographic results concerning muscle activation due to AT training. Movement kinematics of the head appeared to be more flexible, while shoulder flexibility decreased. Self-reports from participants stated that they felt they developed a better awareness of muscular tension, especially in the head and neck.

Most of these studies utilised self-reports as the main method of data collection and conclusions were based on participants' perceptions. Self-reports are important in providing valuable information about how participants see themselves following lessons. There were also several studies that involved quantitative methods, which provided insight into actual changes that took place. However, there is a lack of research that investigates the relationship between self-reports and quantitatively measured outcomes. The main purpose of this study was to explore the possible relationship between pianists' perceptions and the changes in their spinal posture. In this study, pianists described their experiences with the AT (i.e., pianists' perceptions of their posture following lessons in the AT, how they thought they applied principles of the Technique while playing). These perceptions were then compared to quantitatively measured data from a previous study (Wong *et al.*, 2022a).

Method

Study Design

A qualitative descriptive design was chosen for this study as it allows for the description of a phenomenon and the usage of a variety of data collection methods, including documentation (Sandelowski 2000). Qualitative descriptive studies allow for "a comprehensive summary of an event in the everyday terms of those events" (*ibid.*, p. 336). The results of this type of study are presented as a "straight descriptive summary of the informational contents of data organized in a way that best fits the data" (*ibid.*, pp. 338–339). In short, qualitative descriptive studies describe a phenomenon, but still offer an interpretation of the data while staying as close as possible to what participants originally said (Sandelowski 2010).

Participant	Gender	Age	Number of Years Playing Piano	Highest Level of Playing Achieved	Average Number of Hours Practiced Per Day	Average Number of Days Practiced Per Week	Previous Experience with AT [a]	Previous Experience with Other Somatic Methods [a, b]
1	F	18	13	RCM 10	3	5	N	N
2	F	71	60	Bachelor's(?)	1.5	5	N	N
3	F	43	30	RCM 8	1-2	5	N	N
4	F	56	50+	DMA	0	0	N	N
5	M	27	17	Master's	0-1	1-2	Y: 1 [c]	Y: 2 FM
6	F	22	8	RCM 9	4	7	N	Y: 1 BM, 5 FM
7	F	62	40+	RCM 10	0	0	N	N
8	F	36	29	PhD	2	5	Y: 1 [d]	Y: 1 BM, 1 FM
9	F	19	10+	Bachelor's	1-2	2-3	N	N
10	F	21	13	RCM 9	2	1-2	N	N
11	F	28	23	Master's	4	6-7	Y: 3 [c], 2 [d]	Y: 1 BM [e], 1 FM
12	F	59	40	RCM 10	10 min [f]	5	N	Y: 20 FM
13	F	19	11	RCM 9	1	6	N	N
14	M	22	16	Master's	4-6	7	N	Y: 8 BM
15	M	27	13	Master's	6	7	Y: 6 months [d]	N

[a] Y = yes, N = no

[b] BM = Body Mapping session, FM = Feldenkrais Method session

[c] Private AT session

[d] Group AT session

[e] Participated in BM study for unspecified length of time

[f] Prior left arm injury still a factor at start of study

Table 1: Participant demographics.

Participants

Ethical approval was granted by the Research Ethics Board of the University of Ottawa prior to the beginning of this study. The responses of fifteen pianists (12 females, 3 males) between the ages of 18 and 71 who participated in a previous study (Wong *et al.*, 2022) were analysed in this study. All participants were required to be playing at Level 9 or higher, based on the standards of the Royal Conservatory of Music (RCM), or studying piano at a university level at the time of data collection, or to have studied piano at a university level prior to data collection. All participants still played the piano at the time of the study. In addition, participants could not have previously had more than two private (one-on-one) sessions in the AT to prevent biasing the data. Sources on the AT (Cacciatore, Horak & Henry 2005; Gelb [1981]2004; Tarr 2008) vary in the number of lessons required to establish a basic understanding of the AT, but it is generally understood that two lessons are not

sufficient for a student to understand and apply the AT. A summary of participants' demographics can be found in Table 1.

Data Collection

Participating pianists received 10 one-on-one lessons in the AT over the course of two weeks. At the post-test, they were asked to rate themselves on whether they felt they had good posture after lessons in the AT (1 = no, 3 = somewhat, 5 = yes). They were also asked to rate themselves on how often they applied their AT learning to their playing (1 = never, 10 = always). In addition to rating themselves, participants were given an open-ended question asking them to write about how they applied the AT to their playing. At the follow-up, they were again asked to rate themselves on how often they applied the AT to their playing (1 = never, 10 = always). They were also given the same open-ended question as before, asking them to describe how they applied the AT while playing. At the follow-up, pianists were not able to see their responses from the post-test.

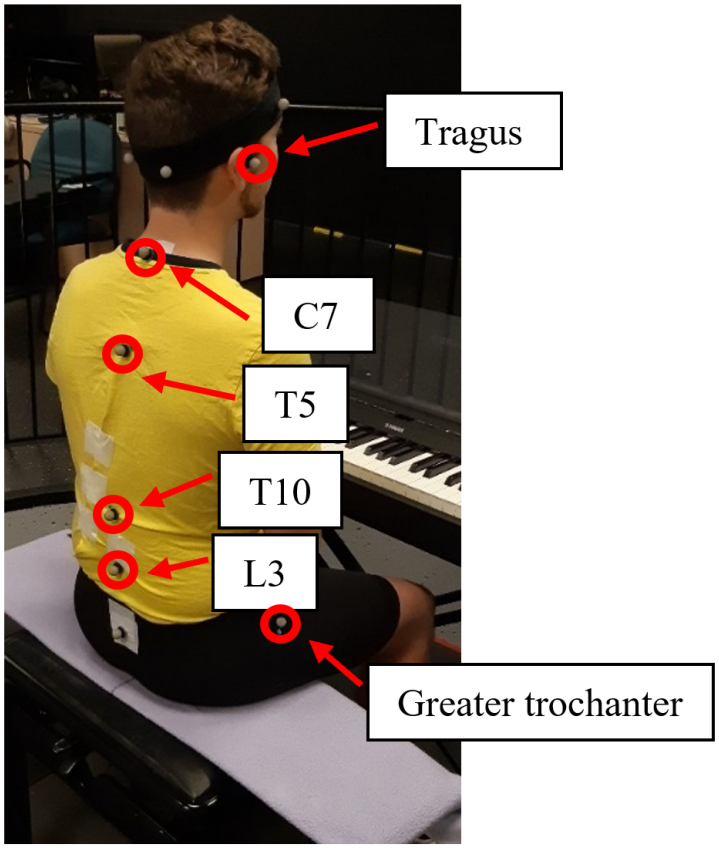

Figure 1: Marker placement for the calculation of postural angles.

In a previous study (Wong *et al.*, 2022a), the same pianists who participated in this present study had their spinal posture measured before and after AT training. The angles measured were related to the AT principle of *primary control*, which refers to the relationship between the head, neck, and trunk (Alexander 1946; Conable & Conable 1995). Therefore, the postural angles measured related specifically to angles

along the axial skeleton. Reflective markers were placed on participants and the following angles were calculated from the participants' right side in the sagittal plane (see Figure 1):

- Craniovertebral angle: formed by connecting the tragus and C7, relative to the horizontal;
- Head-neck-trunk angle: formed by connecting the tragus, C7, and the greater trochanter of the right femur;
- Trunk angle: formed by connecting C7, T10, and the greater trochanter of the right femur;
- Thoracic angle: formed by connecting C7, T5, and T10;
- Thoracolumbar angle: formed by connecting T5, T10, and L3.

Data Analysis

1. Participant Perception

Participant ratings were interpreted. For example, for participants who rated themselves 4 out of 5 for their own posture following AT lessons, it was interpreted to mean that they felt they had good posture after lessons, but not as confidently as those who had rated themselves 5 out of 5. In the case of how often participants applied the AT while playing, pianists who rated themselves 7 or 8 out of 10 were considered to have applied the Technique often while playing.

Conventional content analysis was conducted on participants' responses to open-ended question (i.e., how participants applied the AT while playing) for both post-test and follow-up responses. Participants' answers were then divided into meaning units followed by coding and categorization of the meaning units.

2. Participant Posture

Previous studies (Wong *et al.* 2022a, b) found that there were measurable changes in spinal posture between pre-Alexander and post-Alexander lessons and that there were specific changes in postural angles between pre- and post-lesson measurements. Namely, the craniovertebral and head-neck-trunk angles would be larger and the trunk, thoracic, and thoracolumbar angles would be smaller following lessons. To compare participants' responses with the changes in their spinal posture collected from a previous study (Wong *et al.* 2022a), calculations were made to determine how closely participants followed the expected trend from pre-lesson to post-lesson measurements and if their follow-up measurements demonstrated a reversion in the direction of their pre-lesson measurements.

Trend Percentage. The trend percentage summarizes how closely a participant followed the expected postural trend following lessons in the AT, by expressing the total number of times a participant exhibited the expected change for each postural angle as a percentage of the total number of postural angle measurements. This was calculated for each participant's post-test and follow-up measurements, in relation to pre-lesson measurements.

Reversion Percentage. The reversion percentage summarizes how many angles in the follow-up demonstrate a reversion, or a return, in the direction of pre-lesson measurements compared to post-test angles, by expressing the total number of follow-up angles showing a return in the direction of pre-test measurements as a percentage of the total number of postural angle measurements. This was calculated for each participant's follow-up measurement.

3. Descriptive Report

A description was written of each participant's perception of their posture as well as their experience with the AT. The reports also describe the potential relationship between participants' perceptions and their postural data. For each participant, their demographics and playing history are presented, followed by the results of their post-test (i.e., participants' perceptions of their posture after lessons, how frequently they applied AT principles to piano playing, how they applied principles of the Technique, results from their postural data, and commonalities between participants' experiences and the postural data). The results of their follow-up (i.e., how frequently participants applied AT principles to piano playing, how participants applied principles of the Technique, results from their postural data, how their post-test and follow-up results compare, and commonalities between participants' experiences and the postural data) are presented following their post-test results. A table summarizing these findings is also presented at the end of the Results section (see Table 2).

Results

Participant 1

1. Post-Test

When asked to rate her posture following lessons in the AT, Participant 1 gave herself 4 out of 5, indicating that she felt she played with good posture. When asked to rate herself on how frequently she applied principles of the Technique to her playing during a typical practice session, Participant 1 gave herself 6 out of 10, indicating that she would sometimes attempt to apply AT principles. Answering the open question about how she tried to apply the AT to her playing, Participant 1 wrote, "I tried to pay more attention to sitting up and applying pressure through the length of the arm, rather than just the fingers or wrists. I tried not to slouch over or bend too much when reaching across the piano, and to keep my forearms generally level." Postural angle data collected at the post-test showed that she demonstrated the expected change from pre-Alexander lessons to post-Alexander lessons with every angle in every task following the pattern of larger craniovertebral and head-neck-trunk angles as well as smaller trunk, thoracic, and thoracolumbar angles. Only the head-neck-trunk angle in one of the tasks did not follow the expected pattern of change from pre-test to post-test. When comparing the reported experience of Participant 1 to the postural data, some commonalities were found. Participant 1 felt she played with better posture, and that she focused on not slouching or bending as she played. Her postural

data showed that she demonstrated an overall pattern of spinal extension, indicating that she was indeed slouching less in the post-test in comparison with her pre-intervention measurements.

2. Follow-Up

Participant 1 again reported on how often she applied AT principles to her playing and what she did to apply those principles. Concerning how often she applied principles, Participant 1 gave herself a score of 6, showing that she continued to apply principles some of the time during her practice sessions. When asked how she applied AT to her playing, she wrote:

> By generally being conscious of my body and spine position, leaning instead of scrunching when reaching high or low notes and exerting force through the arm instead of the wrist. I also try to be more aware of adjusting the seat before I sit, so I can play with better posture.

In the comparison of the postural data from the follow-up to that of the pre-test, Participant 1 continued to exhibit the expected postural trend for all angles in all tasks, except for the craniovertebral angle in one of them and the trunk angle in two others. In the comparison of the postural data from the follow-up to that of the post-test, Participant 1 sometimes demonstrated postural angles that were similar between the two measurement sessions. Other times, she appeared to revert to measurements like those seen in her pre-test, but not enough to be a full reversion. In general, there appeared to be similarities between the participant's perception of herself concerning her posture and the postural data. She continued to demonstrate a pattern of spinal extension in comparison to her pre-test, indicating that she was not slouching as much in the follow-up. However, in comparing the follow-up to the post-test, results showed that her overall spine shape was not as upright as that seen in her post-test. This could be that without lessons, there is a lack of constant reinforcement of Alexander principles, leading to a return to pre-intervention posture.

Overall, Participant 1's thoughts about her posture appear to agree with the postural data collected. A focus on not slouching while she practiced may relate to the spinal extension seen in her post-intervention posture.

Participant 2

1. Post-Test

Participant 2 rated herself on how she perceived her posture following lessons in the AT and gave herself a score of 3 out of 5, indicating that she felt she had somewhat good posture after lessons. Participant 2 also rated herself 7 out of 10 for how frequently she tried to apply the AT during a typical practice session, indicating that she would often apply Alexander principles while playing. When asked how she applied these principles to her playing, she wrote, "I apply it most when playing scales and also when I'm playing something that uses the ends of the piano (a Brahms Rhapsody for example). I'm never quite sure whether the AT lessons have

actually 'taken.'" Postural data collected at the post-test showed that Participant 2 followed the expected trend between pre-test and post-test. The only exceptions were the trunk angle in one task and the thoracic angle in another. When comparing her thoughts to the postural data, a commonality was found. She stated that she tried to apply the Technique while playing scales and the postural data showed that there were consistently larger changes measured in the scale-playing task as compared to the other tasks, indicating that the conscious application of AT while playing scales can affect a change in posture. While Participant 2 herself was not sure if the lessons had worked for her, her postural data showed that there was a change in her posture following lessons. This is a demonstration of the AT principle, "faulty sensory awareness," in which the student had a false conception of her own body usage.

2. Follow-Up

Participant 2 again rated herself on how frequently she tried to apply AT principles in the weeks between the post-test and follow-up. She gave herself a score of 6 out of 10, indicating that she sometimes applied AT concepts during piano playing. Concerning how she applied those principles while playing, she wrote, "I find I think about it when playing scales, as these can go right to each end of the piano. Also, when playing big chords in the bass. But it's difficult to remember at other times when I'm concentrating on the tricky bits or reading." Postural data taken at the follow-up showed that Participant 2 continued to exhibit the expected change between the pre-test and follow-up except for the head-neck-trunk angle in one task and the thoracolumbar angle in two tasks. When comparing the data between the post-test and the follow-up, there were some angles that showed a continued trend towards post-AT posture. However, in general, there was some reversion to measurements closer to those seen in the pre-test, just not enough to be a complete reversion. Participant 2 stated that she tried to apply AT principles while playing scales, but the postural changes that were measured were not as distinct in the follow-up as they were in the post-test for this task. With regards to playing chords, the excerpt participants were asked to play had some chords, but Participant 2 did not show any changes that were markedly different in the playing task in comparison with the other tasks. Perhaps this was because most of the chord was played in the treble part of the piano instead of the bass, which was when she would try to apply concepts. As for having difficulty remembering to apply the Technique while reading, Participant 2 did not show any notable differences in posture during the playing or sight-reading tasks.

In general, Participant 2 demonstrated the expected postural change from pre-Alexander lessons to post-Alexander lessons. It was apparent during the scale playing task in the post-test, which was an area in which she had focused on applying the AT. However, at the time of the follow-up, her posture had begun to change in the direction of her pre-test posture, but had not completely reverted.

Participant 3

1. Post-Test

Participant 3 rated herself on whether she felt she played with good posture after having had lessons in the AT. She gave herself a score of 2 out of 5, indicating that she did not feel as if she had good posture after lessons. When asked to rate herself on how often she applied principles of the Technique during a typical practice session, she rated herself 2 out of 10, indicating that she almost never applied Alexander concepts to her playing. Nevertheless, she still wrote about her experience with AT lessons and how she tried to apply some principles when those occasions arose:

> I found myself unconsciously reverting back to old habits and routines more often than not. However, there were several times, particularly towards the end of the lessons that I found myself more consciously applying some of the instructions or practices. We spent quite a bit of time sitting and standing and I did definitely have more awareness of my neck, back and knees while doing so. I was also more acutely aware of where tension builds up while practicing (in my left forearm and right shoulder). At these points, again during the later days of the lessons, I would try to incorporate more of the techniques (ie. awareness of finger-tips to shoulder blades, armpits pointing in opposite directions) while continuing the practice session.

Postural data collected at the post-test showed that Participant 3 followed the expected trend between pre-Alexander and post-Alexander lessons with the exception of the craniovertebral angle in two tasks, the head-neck-trunk angle in two tasks, the thoracic angle in three tasks, and the thoracolumbar angle in one task. Despite her perception that she did not have good posture after lessons in the AT, the postural data showed that Participant 3 followed the expected change in spinal angles from pre-test to post-test. She did not adhere perfectly to the pattern in that not all angles in all tasks changed in the predicted way, but many angles did. While Participant 3 reported that she mostly did not apply principles of the Technique, her postural data still showed the anticipated change after lessons in the AT. However, during Alexander lessons, she did develop an awareness of her neck and back as well as of excessive tension in her body. The increased awareness of one's own body is an important component of the AT and may account for the changes seen in her post-test postural data. In the case of Participant 3, personal perception was different from the actual change that took place, demonstrating that postural change may happen even if the pianist does not feel that it is.

2. Follow-Up

Participant 3 gave herself a score of 2 out of 10 concerning how often she attempted to apply Alexander concepts to her piano playing. This meant that she almost never applied principles of the AT to her playing, but, as she explained in her response below, she did attempt to apply the Technique in other aspects of her life:

> I've largely been away (3 weeks out of the last 4) - so have not been applying the technique while playing. I did however attempt to "free my neck" while driving long

> distances over the last few weeks and keep my knees parallel (vs. bow-legged) and spread weight evenly over my feet (vs. the outer edges) as are my tendencies.

Postural data from the follow-up session showed that between the pre-test and the follow-up, Participant 3 was still demonstrating the expected changes in posture. She continued to have an awareness of her usual posture and attempted to apply the AT to change those tendencies. However, she adhered less to the pattern of change from pre-Alexander to post-Alexander lessons in comparison with the post-test data. She demonstrated a return to her posture the way it was before she had lessons in the AT, but it was not enough to be a full reversion.

Overall, Participant 3 demonstrated the expected change from pre-Alexander to post-Alexander lessons despite her reported lack of application of AT principles. She demonstrated that even if one does not have a positive personal perception of one's own posture, it does not necessarily equate to a lack of postural change when measured objectively. The results of Participant 3 showed that it is possible to exhibit postural change right after lessons in the AT, likely because up to that point, she had a teacher's guidance, but if there is a lack of continued application of the principles after lessons have ended, there will be a rapid return to a pre-Alexander posture. Despite this, awareness of one's own body may be a factor in influencing changes in posture.

Participant 4

1. Post-Test

Participant 4 gave herself a score of 5 out of 5 when asked to rate herself on whether she felt she played with good posture after having had Alexander lessons, indicating that she felt she had good posture following lessons. When asked to rate how often she applied principles of the Technique while playing, she gave herself a score of 10 out of 10, indicating that she always tried to apply the AT to her playing. Her comments about her experience with the AT said, "The most striking thing of Alexander Technique was that you play from the back-centred; playing from the shoulder back." Postural data collected at the post-test showed that Participant 4 followed the expected trend from pre-Alexander to post-Alexander lessons. All angles in all tasks followed the expected pattern of change except for the craniovertebral angle in two tasks, the head-neck-trunk angle in two tasks, and the thoracic angle in one task. Participant 4 seemed to focus on her back, which corresponded with the trunk, thoracic, and thoracolumbar angles in the postural measurements. These were the angles that changed most consistently between the pre-Alexander and post-Alexander lessons (i.e., these angles always changed in the expected manner between pre-test and post-test in all tasks, except for the thoracic angle in one task). It appears that, in the case of Participant 4, the area in which one focuses is the area in which one will most likely exhibit consistent change in a variety of playing tasks. She also felt that she played with good posture after having had lessons and her postural data supported her perception in that her spinal angles changed in the expected direction between pre-test and post-test.

2. Follow-Up

When asked to rate herself on how often she tried to apply AT principles to her playing, Participant 4 once again gave herself a score of 10 out of 10, indicating that she felt she always tried to apply Alexander concepts while playing. Concerning how she applied the Technique to her playing, she wrote, "More aware of my body movements especially core as I turn sideways or [when] moving to [the] right or left. More aware of how I sit and my placement of feet." Her postural data from the follow-up showed that between the pre-test and the follow-up, Participant 4 demonstrated the expected pattern of change in most angles except for the craniovertebral angle in one task, the head-neck-trunk in one task, the trunk angle in one task, and the thoracolumbar angle in four tasks. In her comments about her application of AT principles, Participant 4 stated that she had increased awareness of her body movements and how she sat at the piano. This is reflected in her follow-up posture in that she continued to demonstrate the expected change between pre-Alexander and post-Alexander lessons. Between the post-test and the follow-up, a few angles showed some continued development in the direction of post-lesson changes. However, between the post-test and the follow-up, there was generally a reversion in her posture in the direction of her pre-test measurements. This may be because she was no longer taking lessons and was not having the principles reinforced by a teacher.

Participant 4 demonstrated that her perception of her own posture was supported by the postural data taken at the post-test. She felt she had good posture and the result of the postural measurements showed that she was indeed demonstrating the expected trend between pre-Alexander and post-Alexander lessons. Her focus on her back as well as an increased awareness of her body movements while playing may have contributed to the change seen in her spinal angles in both the post-test and follow-up. Despite a reversion in the direction of her pre-Alexander posture at the follow-up, Participant 4 still showed the expected postural changes between pre-Alexander and post-Alexander lessons, although not to the same degree as that seen in the post-test.

Participant 5

1. Post-Test

Participant 5 gave himself a score of 3 out of 5 when asked if he felt he played with good posture after having had lessons in the AT. His self rating indicated that he felt he had somewhat good posture after lessons. When asked to rank how often he applied the AT to his piano playing, he gave himself a score of 6 out of 10, indicating that he sometimes tried to apply Alexander principles. Concerning his experience with how he applied the Technique, he wrote:

> I think about freeing my neck to allow my head to go forward and up. I am more conscious of my sit bones and how I shift my weight from side to side. I now try to have less sideways movement with my torso and be aware of the full length of my arms from the fingertips to the shoulder blades. I also try to think about not letting my throat (front part of my neck) go forward.

Postural data collected at the post-test showed that Participant 5 followed the expected pattern of change for every angle in every task from pre-test to post-test. Despite his perspective that he had somewhat good posture, his measurements show that his posture had certainly changed. Participant 5 thought a lot about his body and its movements. He mentioned several different parts of his body (i.e., neck, head, torso, sit bones, arms) indicating that he did not focus solely on a single part. The AT tries to teach students to focus on the body as a whole rather than on individual parts, and Participant 5 appeared to develop this whole-body awareness, which may have led to the clear change in his posture.

2. Follow-Up

Participant 5 gave himself a score of 5 out of 10 for how often he tried to apply the Technique while playing. This indicated that he sometimes tried to apply AT principles during his practice sessions. Writing about how he applied the AT, he wrote:

> I tried to direct my head forward and up and to not let my throat come forward. I tried to feel the entire length of my arm back to the shoulder blades. When sitting I tried to not let my lower back collapse and have my hips a little bit further back. When shifting my body side to side, I also try to keep my opposing side hip from lifting off the bench (maintain its length).

Postural data collected at the follow-up showed that Participant 5 followed the expected pattern of change from pre-Alexander to post-Alexander lessons. All angles in all tasks demonstrated the trend with the exception of the thoracic angle in three tasks. Participant 5 again focused on his whole body and continued to be aware of his movements which, when comparing the follow-up to the pre-test, may have led to a continued demonstration of post-Alexander lesson posture. In his comments about his experience with the AT, Participant 5 mentioned his lower back, but not his upper back, which may account for the exceptions concerning the postural trend being found in his thoracic spine. When comparing his post-test posture to the follow-up, it was found that some angles continued to follow the expected postural trend, but others demonstrated a reversal in the direction of the pre-test posture. In general, there was a reversion when comparing the post-test to the follow-up.

In general, Participant 5 demonstrated that while he did not feel entirely confident about having good posture after lessons and felt that he did not apply principles of the Technique all the time, it was still possible to exhibit a change in posture. Participant 5 mentioned at both his post-test and his follow-up that he thought about directing his head "forward and up," a key component of the AT, which may be responsible for the changes seen in his posture. He showed that he had an awareness of his whole body, and even though his follow-up posture showed some return to his pre-test posture, the expected postural trend was still present when comparing his pre-test to his follow-up measurements. This is likely because he continued to think about his body and its movements, and continued to have a whole-body awareness.

Participant 6

1. Post-Test

Participant 6 was asked to rate herself on whether she felt she played with good posture after having had lessons in the AT. She gave herself a score of 3 out of 5, indicating that she felt she had somewhat good posture after lessons. Concerning how often she tried to apply principles of the Technique during practice sessions, she gave herself a score of 5 out of 10, indicating that she sometimes applied the AT while playing. When asked about how she applied the Technique to her playing, she wrote, "Thought of head/neck/back relationship to improve posture. Found more weight in my fingertips by making use of whole arm all the way up to the shoulder blade in the back. Avoided tensing my neck while playing big/accented chords." Postural data collected at the post-test showed that Participant 6 followed the expected postural trend from pre-Alexander to post-Alexander lessons for all angles in all tasks except for the thoracic angle in five tasks. When comparing Participant 6's experience to her postural data, some commonalities can be seen. Participant 6 stated that she thought about the head-neck-back relationship, a principle that is central to the AT, to "improve posture." Based on the postural measurements obtained from her post-test measurements, it was found that between her pre-test and post-test, she followed the expected pattern of change. While she felt she only had somewhat good posture after lessons, her postural data showed that, in fact, all measured postural angles except for one had changed in the anticipated manner, demonstrating the expected pre-lesson to post-lesson pattern.

2. Follow-Up

Participant 6 was again asked to rate herself on how often she applied principles of the Technique while she played. She gave herself a score of 3 out of 10, indicating that she rarely tried to incorporate concepts into her playing. Concerning how she applied the AT when she did try to integrate it to her playing, she wrote, "I thought about the alignment of my head and neck with my spine. I tried to incorporate my whole upper body into playing in the highest and lowest registries [*sic*]." Postural data collected at the follow-up showed that in comparison to the pre-test, Participant 6 demonstrated the expected change in posture. She again thought about the head-neck-back relationship, which may account for the changes seen between pre-test and follow-up despite her lack of application. When comparing the postural measurements taken at the post-test to those taken at the follow-up, it was found that some angles demonstrated continued change in the direction of pre-Alexander to post-Alexander lesson posture, while other angles showed a slight reversion in the direction of the pre-test measurements. However, calculations to determine how closely the participant adhered to the expected postural change showed no general difference between the post-test and the follow-up. That is, she scored 86% at both the post-test and the follow-up for how closely she followed the expected change from pre-Alexander to post-Alexander lessons. While the scores were the same, the exceptions at each measurement session were different. In the post-test, her exceptions to the pattern

were all found in the thoracic angle. In the follow-up, her exceptions were found in the trunk angle in three tasks and the thoracic angle in two tasks. Based on this calculation, her posture at the follow-up is at the same level as at the post-test. When comparing the follow-up comments of Participant 6 to her postural data, although she felt she applied the Technique even less than at the time of the post-test, she still demonstrated changes in her posture in comparison with her pre-test. This may be because she continued to think about her head-neck-back relationship, a central element of the AT.

In general, Participant 6 demonstrated the expected trend from pre-Alexander to post-Alexander lessons in both the post-test and the follow-up. While she felt that she did not apply AT principles very often, she did think about the head-neck-back relationship, which may account for the changes seen in her posture following lessons in the AT.

Participant 7

1. Post-Test

Participant 7 was asked to rate herself on how she perceived her posture after having had lessons in the AT. She gave herself a score of 5 out of 5, indicating that she felt she had good posture after having Alexander lessons. When asked how often she tried to apply Alexander principles to her playing, Participant 7 gave herself a score of 9 out of 10, indicating that she almost always tried to apply Alexander concepts. Concerning how she applied the Technique to her playing, she wrote, "I keep my neck in the right position, do not lean forward my neck when playing. I [rotate] my body when playing the scale from [the] lower to the higher [registers] and keep my bottom…on the chair. [Expand] shoulder blade when playing chords." Postural data collected at the post-test indicated that Participant 7 followed the expected postural trend between pre-test and post-test with exceptions for the craniovertebral angle in three tasks, the head-neck-trunk angle in five tasks, and the thoracolumbar angle in five tasks. A comparison of the participant's perception with the postural data shows that although she felt she played with good posture following lessons, a few angles did not follow the expected pattern in several tasks. However, she mentioned the application of Alexander principles during scale playing specifically and for that task, the postural data showed that all angles followed the expected pre-lesson to post-lesson trend. Participant 7 also thought about her neck position while playing, specifically in not allowing the neck to jut forward while playing, which can result in a forward head posture. One component of the AT is thinking about allowing the head to go "forward and up," which lessens forward head posture. Her craniovertebral angle, a commonly-used measure to examine forward head posture, demonstrated the expected pre- to post-lesson pattern for several tasks, indicating that she was successful some of the time in decreasing how far forward she projected her neck.

2. Follow-Up

Participant 7 again rated herself on how often she tried to apply Alexander principles to her playing. She gave herself a score of 7 out of 10, indicating that she often tried to apply concepts while playing. Concerning how she applied the Technique, she wrote, "While playing, turn your body to the direction instead of moving your body from side to side. Using shoulder to raise your arms to the keyboard instead of just arms rising. Sitting position to keep your lower back curved." Postural data indicated that she followed the expected trend from pre-Alexander lessons to post-Alexander lessons when comparing between the pre-test and the follow-up although there were some exceptions, particularly for the thoracolumbar angle in which none of the follow-up results demonstrated the expected pattern. Participant 7 again focused on applying the Technique when moving to extremes of the keyboard, reflected in her scale playing. Once again, all measured angles demonstrated the expected pattern of change in scale playing except for the thoracolumbar angle, possibly due to her awareness of her body while playing scales in particular. A possible reason why her thoracolumbar angle did not demonstrate the expected change could be that she tried to "keep [her] lower back curved." In trying not to overextend her lower back, she may have overcompensated by flexing the thoracolumbar spine too much, leading to the results seen in the follow-up measurement. When comparing the post-test to the follow-up, a reversion in the direction of her pre-test measurements can be seen, although not enough to demonstrate a complete return.

Overall, Participant 7's perception did not always reflect the postural data taken at the post-test and follow-up. She felt that she had good posture after lessons, as reflected in how she rated herself, and she felt that she had often applied principles of the Technique, but she demonstrated a number of exceptions when comparing her postural results to the expected post-lesson trend. However, this may be due to overcompensation. In trying to change her posture directly, she may have overdone it, resulting in the postural data collected at the post-test and follow-up. In addition, her choice of words reflected an attempt to change her posture for herself, which is contradictory to what the AT teaches. The AT asks its students to become aware of undesirable posture and patterns in themselves and to stop them. This is followed by saying Alexander directions to themselves to activate the hands-on experiences given to them by their teachers during lessons, which leads to a change in posture and movement. Participant 7 appeared to actively try to change herself to achieve the posture she thought was required of her even though the AT teaches that there is no set posture. It is possible, however, that her choice of words may have been how she construed the AT in her mind to help her remember the sensations she experienced while taking lessons with a teacher. Despite the number of exceptions and her involved efforts, Participant 7 still generally demonstrated the post-lesson trend.

Participant 8

1. Post-Test

Participant 8 rated herself on whether she felt she played with good posture after having had lessons in the AT. She gave herself a score of 4 out of 5, indicating that she felt she played with good posture following lessons. She also rated herself on how often she applied what she learned in the AT to her playing. She gave herself a score of 8 out of 10, indicating that she often tried to apply AT principles to her playing. Concerning how she applied the Technique, she wrote:

> The first instruction of the Alexander Technique is very useful for me. "Allow neck to be free" gives me freedom because I used to have neck pain. With Alexander Technique I could learn how I manage my body weight. I could realise how my body posture changes. I think it is very important, because as a pianist, my body is my instrument. So, these experiences led to many changes for me. I will continue taking lessons in Alexander [Technique].

Postural data collected at the post-test indicated that Participant 8 followed the expected trend from pre-test to post-test. However, she exhibited several exceptions with each angle deviating from the pattern in at least one task. When comparing her experience with the AT to her post-test postural data, there are slight discrepancies in that she felt she had good posture after lessons and that she had changed, but her exhibited postural pattern did not always follow the expected trend. While she focused on her neck, exceptions to the postural trend were found in the craniovertebral angle for a few tasks. However, she did appear to develop an awareness of her body, which is an important part of the AT. This may account for the changes seen in her post-test in comparison with her pre-test.

2. Follow-Up

Participant 8 again rated herself on how often she applied the Technique to her playing. She gave herself a score of 8 out of 10, indicating that she often tried to apply concepts while playing. Writing about her experience, she said:

> I am applying most of my practicing time. Especially when I was playing difficult passage, the Alexander Technique was very useful for me because I could manage my body and feeling. Also, I could feel energy of my body, and I could focus on my body posture. It was great [experience].

Postural data collected at the follow-up showed that Participant 8 followed the expected pattern of change from pre-test to follow-up for all angles in all tasks except for the trunk angle in four tasks and the thoracic angle in three tasks. When comparing the post-test to the follow-up, Participant 8 demonstrated a continued development in the direction of post-lesson postural change for some angles. Comparing the scores for how closely the participant followed the expected trend showed that she followed the pattern more closely in the follow-up than in the post-test. Participant 8 stated that she was applying the Technique most of the time while practicing and she continued to

cultivate a whole-body awareness of herself. This may account for why she followed the expected pattern of change more closely in the follow-up than in the post-test.

In general, Participant 8 followed the expected postural change from pre-Alexander to post-Alexander lessons. While there were some discrepancies between her perception of her own posture and the postural data at the post-test, she exhibited a closer following of the expected pattern at the follow-up. She felt that she applied the AT often, prior to both the post-test and the follow-up. While this was not immediately apparent at the post-test, the postural data collected at her follow-up reflected that the continued application of principles can lead to continued postural change, even if those changes are not clearly noticeable directly following lessons.

Participant 9

1. Post-Test

Participant 9 rated herself on how she perceived her posture after having had lessons in the AT and gave herself a score of 4 out of 5, indicating she felt that she had good posture after lessons. She also rated herself on how often she tried to apply what she learned from the AT to her playing. She gave herself a score of 7 out of 10, indicating that she often tried to apply the Technique while playing. Concerning how she applied the AT, she wrote:

> I tried to imagine my body/arms not sinking in the piano but more like away from piano. I applied Alexander Technique mostly when I was practicing scales, and I focused on my body moving more like followed by my finger/arm motion. I was feeling my both feet rooted on the ground.

Postural data collected at the post-test showed that Participant 9 exhibited the expected changes from pre-test to post-test for all angles in all tasks with the exception of the thoracolumbar angle in three tasks. There are some commonalities between what Participant 9 perceived about herself and her postural results. She felt that she played with good posture after lessons, and she felt that she applied principles of the Technique often. Her postural data showed that she followed the expected postural trend from pre-Alexander to post-Alexander lessons, indicating that there was indeed a change after her experience with the AT. In addition to applying AT principles often, she also appeared to develop an awareness of her whole body and its movements in relation to the piano, which may account for why she followed the trend closely. She also stated that she mostly applied the Technique when practicing scales, but her results showed that her postural angles changed in more than just one task, again possibly due to the frequency of the application of the Technique as well as her increased body and movement awareness.

2. Follow-Up

Participant 9 was asked to rate herself on how often she applied the AT to her playing. She gave herself a score of 8 out of 10, indicating that she felt she applied the

Technique often while playing. When asked to write about how she applied the AT to playing, she wrote:

> I tried to mostly think about relationship between me and the piano, me (my arm is pushed against the piano, and me and piano are sort of away from each other). Sometimes I felt really tired maintaining the posture and had to do a few scales in a short time. I still didn't know how to apply Alexander Technique with a pedal, but when I am not, I could relate it [AT] to practicing a bit more (sitting straight and my body and piano away from each other). It was hard to focus on the music especially when I sight read with Alexander Technique.

Postural data collected at the follow-up showed that Participant 9 followed the expected trend from pre-Alexander to post-Alexander lessons when comparing the pre-test to the follow-up. Exceptions to this were found for the craniovertebral angle in one task, the head-neck-trunk angle in two tasks, and the thoracolumbar angle in one task. Participant 9's comments indicated that she continued to be aware of her body and its relation to the piano. While she found it difficult to focus on playing, especially while sight-reading, her postural results showed that, compared to her pre-test measurements, her posture had changed, perhaps because of this continued body and movement awareness. Additionally, all angles followed the expected trend during the sight-reading task, which shows a discrepancy between her perception of herself and her postural results. When comparing the post-test results to the follow-up, a return towards her pre-test posture was found, but it was not enough to be a complete reversion. In general, her posture continued to follow the expected post-lesson trend in the follow-up, but not as closely as she did in the post-test. This could be because she did not have a teacher to continue giving her the experiences associated with Alexander principles. However, since she continued to think about how to apply the AT to her playing, she did not completely return to her pre-test posture.

Overall, Participant 9 followed the expected postural trend from pre-Alexander to post-Alexander lessons. Immediately after lessons, she felt that she had good posture, and the postural data indicated that she had changed in the expected manner, showing some commonalities between her assessment of herself and her postural measurements. While she did not always feel confident that she was successfully applying AT principles to her playing, her postural results showed that her posture did change across all tasks. This may be because she developed a whole-body awareness, especially in relation to the piano, resulting in the postural changes that were found.

Participant 10

1. Post-Test

Participant 10 was asked to rate her posture and gave herself a score of 4 out of 5, indicating that she felt she had good posture after lessons. Additionally, she was asked to rate herself on how often she applied what she learned from the AT to piano playing. She gave herself a score of 8 out of 10, indicating that she often applied principles of the Technique to her playing. Concerning how she applied the AT while playing, she wrote, "I have to keep my feet on the ground to support myself and use

the strength from my lower back and bring it to my shoulders, arms and hands while playing. My back and head have to be straight and neck and hands should be loose." Postural data collected at the post-test showed that all angles in all tasks followed the expected trend for postural change between the pre-test and the post-test. Exceptions to this were found for the head-neck-trunk angle in one task and the thoracic angle in two tasks. There were some similarities between what Participant 10 perceived about herself and her postural measurements. She felt that she played with good posture after receiving lessons, and her postural data showed that her measurements changed in the expected manner. She also felt she applied principles of the Technique often to her playing, which is reflected in how closely she followed the post-lesson trend. However, her choice of words (i.e., "have to") while reflecting on how she applied the Technique is interesting in that the AT does not force its students into positions. The AT provides directions that serve as instructions to the student concerning how to prepare the body for movement and how to use the body during movement. Directions do not provide a set posture to be achieved. Participant 10's word choice in her comments may have been the way she interpreted the Technique to help her remember what to do, although actively trying to change one's posture is not encouraged in the AT.

2. Follow-Up

Participant 10 was asked to rate herself on how often she applied concepts of the Technique to her playing in the interim between the post-test and follow-up. She gave herself a score of 7 out of 10, indicating that she felt she applied them often. She was also asked to write about how she applied the AT to her playing. She wrote, "I planted my feet to [*sic*] the ground, straightened my back, and lifted my head." Postural data collected at the follow-up showed that, between the pre-test and the follow-up, Participant 10 exhibited the expected pattern. However, the postural results also showed that the expected trend was followed much less closely in the follow-up than in the post-test with several of the measured angles reverting in the direction of her pre-test posture. There are some discrepancies between Participant 10's experience and her postural data. She felt that she applied the Technique often to her playing, but her measurements did not reflect this application, especially considering the difference in how closely she followed the expected postural trend in the post-test versus the follow-up. Her comments written at the follow-up reflected an active involvement in trying to make her body conform to a certain position, which is contradictory to AT teachings. This attempt, combined with the lack of feedback from a teacher, may account for the rapid regression towards her pre-test posture.

In general, Participant 10 exhibited the expected change in postural angles from pre-Alexander to post-Alexander lessons. Her post-test perception of herself had more commonalities with her post-test postural data than her perception of herself at the follow-up. She demonstrated a reversion towards her pre-test posture at the follow-up, indicating that without the continued guidance of a teacher and without a proper understanding of how to apply the Technique, a return towards pre-Alexander posture can occur.

Participant 11

1. Post-Test

Participant 11 was asked to rate herself on how she perceived her posture following lessons in the AT. She gave herself a score of 4 out of 5, indicating that she felt she played with good posture after having had lessons. She was also asked to rate herself on how frequently she applied principles of the Technique while playing. She gave herself a score of 8 out of 10, indicating that she applied AT concepts often. When asked to write about how she applied the AT to piano playing, she wrote, "Observing neck, back, head, arms and their relationship to one another. Readjusting when I noticed a tendency to fall back into an old habit." Postural data collected at the post-test showed that she followed the expected pattern of change from pre-test to post-test. Exceptions were found for the craniovertebral angle in two tasks, the trunk angle in one task, the thoracic angle in six tasks, and the thoracolumbar angle in three tasks. Participant 11 wrote that she observed the head-neck-back relationship, a central element of the AT. She also developed an awareness of her body and recognized when she "[fell] back into an old habit." While she appeared to develop her sense of awareness concerning her body, her posture may not have changed to the degree that she perceived. She felt that she played with good posture after lessons, while her postural data showed that although she did exhibit the post-lesson trend, she also demonstrated several exceptions to the pattern.

2. Follow-Up

Participant 11 was again asked to rate herself on how often she applied the AT while playing. She gave herself a score of 7 out of 10, indicating that she felt she applied the Technique often. Concerning how she applied principles of the Technique, she wrote:

> Considering the length of the skeleton, not just of the spine, but also of the arms in both directions. Stopping to reconsider alignment and the skeleton's position. Stopping to remember the Alexander instructions: "Allow the neck to be free, to allow the head for a release forward and up..."

Postural data collected at the follow-up showed that, when compared with the pre-test, Participant 11 followed the expected trend from pre-Alexander to post-Alexander lessons, although she continued to exhibit several exceptions to the pattern. When comparing the post-test results to those of the follow-up, Participant 11 demonstrated a return in the direction of her pre-test measurements. She continued to think about her body, specifically about her skeletal structure, and she continued to say the Alexander directions to herself. While she did not have a teacher after the post-test, she continued to review and apply key AT principles on her own. This may account for why she showed a return, but not a complete reversion to her pre-test posture.

In general, Participant 11 demonstrated the expected post-lesson trend. However, her perception and her postural measurements did not always agree. Participant 11 thought that she changed more than her measurements showed, in that she felt she

played with good posture following lessons and she demonstrated an understanding of important Alexander principles, but her postural data showed that she followed the postural trend only some of the time.

Participant 12

1. Post-Test

Participant 12 was asked to rate her posture and she gave herself a score of 3 out of 5, but wrote, "better posture, not necessarily 'good'," indicating that she felt she had somewhat better posture following lessons in the AT. She was also asked to rate herself on how often she applied the Technique while playing and she gave herself a score of 7 out of 10, indicating that she often tried to apply what she learned. Concerning how she applied AT principles while playing, she wrote, "Keep my neck 'free.' Try to put/allow my head to be in a better place. Think of line directed through opposite hip when playing in 'extreme' range of piano keyboard." Postural data collected at the post-test showed that all angles in all tasks followed the expected pattern of change from pre-test to post-test except for the craniovertebral angle in one task and the head-neck-trunk angle in one task. There are some commonalities between the participant's perception of herself and her postural data. She felt that she had better posture after lessons, and her measurements showed that she followed the expected trend quite closely. She thought mostly about her head and neck, and although her craniovertebral and head-neck-trunk angles, two angles which measure head and neck positions, did not always follow the expected trend, they exhibited the anticipated changes most of the time.

2. Follow-Up

Participant 12 was again asked to rate herself on how often she applied the Technique to her playing in the time between the post-test and follow-up. She gave herself a score of 5 out of 10, indicating that she sometimes applied AT principles. Concerning her experience with the Technique during the interim, she wrote:

> Initially (i.e., when sitting down at the piano) to get a more settled feeling before starting practice. When practicing difficult passages, AT seemed to lessen tension induced by technical difficulties/challenges. Breaks between practice "bits:" "Breather" - AT seemed to help me breathe deeper and more fully.

Postural data collected at the follow-up showed that, in comparison with the pre-test, Participant 12 followed the expected change in posture for all angles in all tasks. In comparison with the post-test, several of the follow-up angles demonstrated a reversion in the direction of her pre-test posture, although the changes did not show a complete return to her pre-lesson measurements. While Participant 12 stated that she applied principles of the Technique only some of the time, her comments showed that the effects of the AT were for her whole body and not a specific part. She felt a lessening in tension and found that the AT helped her to feel more "settled" before

she began to practice. This effect of the AT on Participant 12 may have led to the measurements seen in the follow-up.

Overall, Participant 12 followed the expected postural trend from pre-Alexander to post-Alexander lessons. While she did not always seem confident about the AT's influence on her, she exhibited the anticipated changes in posture. She initially focused on her head and neck, but eventually found that the AT helped her to reduce tension, which may have led to changes throughout her whole body.

Participant 13

1. Post-Test

Participant 13 was asked to rate herself on whether she felt she played with good posture following lessons in the AT. She gave herself a score of 3 out of 5, indicating she felt that she played with somewhat good posture after lessons. She was also asked to rate herself on how often she tried to apply principles of the Technique to her playing. She gave herself a score of 8 out of 10, indicating that she often tried to apply what she learned while playing. Concerning how she applied principles of the Technique, she wrote, "The main issue I had was being able to make space in the shoulder blade and avoid using my pectoral muscles more than needed. I often had to stop playing to readjust the 'spaced out' position as it always closed back up again once I started playing." Postural data collected at the post-test showed that Participant 13 followed the expected pattern of change from pre-test to post-test, although she demonstrated at least one exception to the trend for all angles except for the thoracic angle, which followed the expected pattern in all tasks. She felt she applied the Technique often while playing, but focused on specific parts of her body like her shoulder blades and pectoral muscles. Her focus on her upper torso rather than her whole body may be the reason why she exhibited multiple exceptions to the expected postural pattern. This may also be why the thoracic angle was the only angle in which no exceptions to the trend were found. However, her perception regarding her own posture showed some similarity with the postural measurements collected at the post-test. Her response indicated that she did not feel very confident about having good posture while playing, although she did not think her posture was bad. She felt she played with somewhat good posture while her postural data showed that she followed the expected trend only some of the time.

2. Follow-Up

Participant 13 was asked to rate how often she applied AT principles while playing. She gave herself a score of 7 out of 10, indicating that she often tried to apply the Technique. When asked to write about her experience applying AT principles, she wrote:

> Because the Alexander Technique is still fairly new to me, the easiest aspects for me to focus on were keeping my neck as relaxed and forward as possible throughout my playing. Additionally, because I have a habit of tensing my wrists, I tried letting go of my forearm muscles as much as possible and finding space in between all my hand and arm joints.

Postural data collected at the follow-up showed that, in comparison with the pre-test, she followed the expected postural pattern of change from pre-Alexander to post-Alexander lessons. Exceptions were found for the trunk angle in two tasks, the thoracic angle in two tasks, and the thoracolumbar angle in three tasks. At the time of the follow-up, her focus appeared to be on her neck and upper extremities, which may be why the exceptions were found in variables relating to her torso rather than in the craniovertebral and head-neck-trunk angles. This is in contrast to her post-test results in which she focused on her upper torso and showed exceptions in all but the thoracic spine. When comparing the postural data from the post-test to the follow-up, it was found that Participant 13 followed the expected pattern more closely at the follow-up. Her comments at the follow-up reflected a change in her thoughts towards more than just her upper torso. This may account for why, in comparison to the post-test, her follow-up results followed the expected trend much more closely. It is also possible that she simply needed more time to practice integrating principles of the Technique into her playing.

In general, Participant 13 followed the expected postural pattern from pre-Alexander to post-Alexander lessons. Her focus on various parts of her body seemed to determine where postural changes were found. She also seemed to demonstrate that time was needed for her to integrate the Technique to her playing, as seen by how closely she could follow the expected trend in the follow-up compared to results seen at her post-test.

Participant 14

1. Post-Test

Participant 14 was asked to rate his perception of his own posture following lessons in the AT. He gave himself a score of 5 out of 5, indicating that he felt he played with good posture after having had lessons. He was also asked to rate himself on how often he applied principles of the Technique while playing, and he gave himself a score of 9 out of 10, indicating that he almost always tried to apply AT concepts while playing. Concerning how he applied the AT, he wrote:

> I begin practice by doing 5-10 minutes of constructive rest. I often practice "Monkey" if my back feels achy or tense. I always sit while thinking of maintaining head and neck alignment. I frequently think of my sit-bones and my head leading my movements, especially when leaning to either side.

Postural data collected at the post-test showed that Participant 14 followed the expected change in posture from pre-test to post-test, with exceptions found for the craniovertebral angle in one task, the head-neck-trunk angle in one task, the trunk angle in all tasks, and the thoracolumbar angle in four tasks. While Participant 14 seemed to think that he played with good posture after lessons and felt that he applied AT principles almost always, his postural measurements showed that while he followed the expected trend, he also demonstrated several exceptions. However, during his practice sessions, Participant 14 did demonstrate some knowledge about how to apply the AT. He seemed to think of the relationship between his head and

neck as well as his contact point with the seat while playing. He mentioned that he applied the Technique specifically while "leaning to either side [of the keyboard]," and his postural measurements showed that he did not exhibit any exceptions to the postural trend during the scale-playing task, except for the trunk angle.

2. Follow-Up

Participant 14 was again asked to rate himself on how often he applied AT principles while playing. He gave himself a score of 8 out of 10, indicating that he often applied concepts of the Technique while playing. When asked to write about how he applied the AT, he wrote, "Posture, especially lower back when sitting, and how I use/hold my shoulders." Postural data collected at the follow-up showed that, compared to his pre-test measurements, Participant 14 followed the expected change in pattern for all angles in all tasks except for the craniovertebral angle in one task, the head-neck-trunk angle in one task, the trunk angle in one task, and the thoracolumbar angle in one task. When comparing the post-test to the follow-up, it was found that Participant 14 followed the expected postural trend more closely in the follow-up than in the post-test. Concerning his application of the AT, Participant 14 continued to apply principles often and he focused on applying it to his posture, specifically to his lower back. This may account for why he followed the postural trend more closely in the follow-up than in the post-test. His continued application of the AT may have led to the continued changes in his posture.

In general, Participant 14 followed the expected postural trend from pre-Alexander to post-Alexander lessons. While he initially felt that he played with good posture following AT lessons, he did not demonstrate the expected change in posture at the post-test as obviously as he did at the follow-up. However, his continued practice and application of the AT may have led to continued change in his posture.

Participant 15

1. Post-Test

Participant 15 was asked to rate his perception of his own posture and he gave himself a score of 5 out of 5, indicating that he felt he played with good posture following lessons in the AT. He was also asked to rate himself on how often he tried to apply principles of the Technique while playing and he gave himself a score of 7 out of 10, indicating that he often applied AT concepts. Concerning his experience with applying the Technique, he wrote, "Awareness of my posture. Relaxation and releasing the tension. Short breaks to rest and laying down. Releasing the tension on my neck." Postural data at the post-test showed that Participant 15 followed the expected pattern of change from pre-test to post-test for all angles in all tasks except for the thoracic spine in all tasks. There are some commonalities between his perception of himself and his postural data. He felt that he played with good posture following lessons and that the AT gave him an "awareness of [his] posture," and his measurements showed that he mostly followed the expected trend, indicating a change in his posture. He also stated that the AT helped him release tension throughout his

body, particularly the tension in his neck. This may be seen in the fact that all angles measured pertaining to the neck (i.e., craniovertebral angle, head-neck-trunk angle) showed the expected post-lesson changes.

2. Follow-Up

Participant 15 was asked to rate himself on how often he applied what he learned from the AT while playing. He gave himself a score of 8 out of 10, indicating that he felt he often applied the Technique. Concerning how he applied the AT, he wrote:

> Every hour or when I feel that I need rest or I am tired I do at least 5 min of Alexander Technique. My piano technique isn't affected by it but I keep on mind Alexander Technique when I am sight-reading since it's when I get [stiff?] without awareness of my own body.

Postural data collected at the follow-up showed that, in comparison with his pre-test measurements, Participant 15 demonstrated the anticipated postural trend with exceptions found for the trunk angle in two tasks and for the thoracic angle in six tasks. Participant 15 continued to apply the AT on his own, especially when sight-reading. His measurements from the sight-reading task showed that all angles demonstrated the expected postural trend except for the thoracic angle. When comparing the post-test to the follow-up, a general pattern of regression was found except for the head-neck-trunk angle, which continued to show changes in the direction of post-lesson changes for most of the tasks. The lack of a teacher to continue giving hands-on experiences of AT ideas during the interim between the post-test and follow-up may account for the regression. However, he did not return completely to his pre-test posture, indicating that with continued application of the AT, it is still possible to exhibit postural measurements that show the expected post-lesson trend.

Overall, Participant 15 demonstrated the expected pre-Alexander to post-Alexander lesson pattern of change. His perception of his posture showed some commonalities with the measurements taken at the post-test and follow-up. The lack of a teacher from post-test to follow-up may account for the difference in posture seen between the two measurements, but his continued application of the Technique may explain why he still exhibited the expected pre-lesson to post-lesson change, although to a lesser degree.

Table 2 provides a summary of the results. There is a variety of responses concerning how participants viewed their own posture following lessons in the AT and how often participants applied AT principles to their playing. The trend percentages show that all participants followed the expected postural trend, although to varying degrees. Participants continued to demonstrate the expected postural trend in the follow-up session, although often to a lesser extent than was seen in the post-test. The reversion percentages demonstrate the percentage of individual postural variables that have reverted in the direction of baseline measurements. The findings show that while pianists continued to demonstrate the expected postural trend at the follow-up, they were not following as closely.

Participant	Participant Perception			Posture		
	Posture perception [a]	Frequency of application [b]		Trend percentage [c]		Reversion percentage
	Post-test	Post-test	Follow-up	Post-test	Follow-up	Follow-up
1	4	6	6	97%	91%	74%
2	3	7	6	94%	91%	49%
3	2	2	2	77%	60%	69%
4	5	10	10	86%	80%	63%
5	3	6	5	100%	91%	49%
6	3	5	3	86%	86%	37%
7	5	9	7	63%	57%	51%
8	4	8	8	66%	80%	26%
9	4	7	8	91%	89%	57%
10	4	8	7	91%	60%	77%
11	4	8	7	66%	57%	60%
12	3	7	5	94%	100%	71%
13	3	8	7	54%	80%	26%
14	5	9	8	63%	89%	29%
15	5	7	8	80%	77%	63%

[a] 1 = no (confidently), 2 = no, 3 = somewhat, 4 = yes, 5 = yes (confidently)

[b] 1 = never, 2 = almost never, 3-4 = rarely, 5-6 sometimes, 7-8 = often, 9 = almost always, 10 = always

[c] 50-59% = not a close following, 60-69% = slightly close following, 70-79% = moderately close following, 80-89% = very close following, 90%-100% = extremely close following

Table 2: Summary of results.

Discussion

Participants' Perceptions

Nine of the fifteen participants felt that they played with good posture following lessons. Only one participant felt they did not play with good posture following AT lessons. Concerning how the Technique was applied, participants focused on a variety of aspects including different parts of their bodies, their head-neck-back relationship, alignment of parts of their bodies, how they sat at the piano, and their posture in general. The AT also brought increased awareness to participants about different parts of their bodies along with awareness of posture in general, their skeletal structure, how they sat at the piano, movement while playing, tension, and weight shift. One participant also became aware of her body's relationship to the piano, and another developed an awareness of the need to adjust the seat before playing. Some participants found that they tended to revert to old habits. This is interesting because one of the main principles of the AT is inhibition: a "suspending [of] habitual responses to stimuli" (Jones 1997, p. 211). To inhibit one's usual response, one must first recognize what their habit is. For participants who stated that they tended to return to old habits, they demonstrated a development of recognizing their typical response to a situation – in this case, playing the piano. Participants also wrote about using the Technique when playing at the extremes of the keyboard, playing scales, and playing chords.

Some referenced Alexander principles in their writings about how they applied the Technique while other participants found the AT difficult to apply while playing.

These perceptions and applications of the Technique agree with studies that have been conducted about the AT. Participants in Soo-Yeon Kim and Soon Gi Baek's (2014) study found that they gained a sense of body awareness. Participants in Pramod P. Reddy and colleagues' (2010, 2011) studies reported that they felt their posture improved after AT lessons while participants in Vivien Gibbs and Pat Young's (2011) study found that the AT changed their body positions. For studies concerning musicians, Davies (2020a, b) found that music students who took one semester of AT lessons felt that the Technique was beneficial for posture and for releasing tension. For studies concerning pianists, one of Kaplan's (1994) findings was that pianists who studied the Technique found that the AT brought increased awareness of the body and its role in piano playing. Pianists who participated in Loo and colleagues' (2015) study reported feeling a decrease in muscular tension following lessons in the AT. The responses given in this present study show that, like Chloe Stallibrass and colleagues' (2005) findings, each participant applied what they had learned during lessons while demonstrating a wide range of applications.

Participants' Postural Trends

All participants followed the expected postural trend from pre-test to post-test, although not all of them followed the trend as closely as others. Many studies have shown that the AT can change posture (Cacciatore, Horak & Henry 2005; Cacciatore *et al.* 2011a, b; Cohen *et al.* 2015; Gross *et al.* 2019; Santiago 2004), but this present study detailed the expected change in spinal angles from pre-Alexander to post-Alexander lessons and determined how closely participants followed this expected pattern. This present study also found that ten of the fifteen participants followed the expected pattern of change less closely at the follow-up than at the post-test. One participant followed the trend the same amount but exhibited different exceptions when they did not follow the trend. Interestingly, four participants followed the expected pattern of change more closely at the follow-up in comparison with the post-test. Those who followed the trend less closely at the follow-up did not show a large change between the post-test and the follow-up, indicating that the AT was still effective in altering posture. All participants demonstrated some reversion in the direction of their pre-test posture when examining individual postural angles, but not to the same degree. Those who exhibited a smaller amount of reversion were also those who showed a closer following of the expected postural trend in the follow-up than in the post-test. The only exception to this observation was Participant 12 who demonstrated a reversion in several measured angles, but overall followed the trend more closely when comparing between pre-test and follow-up rather than between the post-test and follow-up. Despite demonstrating a return in the direction of their pre-test posture, most participants continued to demonstrate a following of the expected postural trend when comparing between pre-lesson and post-lesson measurements.

The results of this study showed that the effects of lessons continued to persist four weeks after the cessation of lessons. Previous studies showed that the effects of taking AT lessons were retained up to a year following lessons, although not all these studies dealt with posture. Paul Little and colleagues (2008) as well as Hugh MacPherson and colleagues (2015) found that the AT was still effective in managing neck and back pain a year following AT lessons. Stallibrass and colleagues (2005) found that six months after lessons in the AT had ended, participants with Parkinson's disease continued to apply the AT. These participants reported that the AT helped them in multiple aspects of their lives, such as sitting and walking. Participants also felt that the AT helped them to relax, improved posture, and reduced pain, indicating that they felt the Technique had lasting effects. Monika Gross and colleagues' (2020) study revealed that between three to six months after lessons had ended, participants with Parkinson's continued to demonstrate improvement in head and neck posture in comparison with their pre-lesson measurements, leading the researchers to conclude that there are long-term benefits associated with learning the AT.

Relationship Between Participant Perception and Postural Trend

No previous studies have examined the relationship between pianists' perceptions of their postures and their measured posture following lessons in the AT. This present study found that being confident about having good posture does not necessarily equate to demonstrating the expected postural change following lessons in the AT. Also, the frequency of applying AT principles did not guarantee whether participants would or would not follow the trend closely. Additionally, participants did not always rate themselves the same way at the follow-up as they did in the post-test. All participants demonstrated a reversion in some postural angles between the post-test and follow-up. However, there appeared to be no relationship between how many of their angles reverted in the direction of their pre-test measurements and the frequency with which they felt they applied the Technique to their playing.

The AT places an emphasis on focusing on the whole body rather than specific parts, so it may be assumed that participants who focused on the whole body might follow the expected postural trend more closely than those who focused on a few specific parts. Nine participants appeared to demonstrate a whole-body awareness and mentioned many different parts of their bodies, the head-neck-back relationship, or posture in a general sense at the post-test based on their comments about how they applied the AT while playing. Of those nine participants, six of them followed the expected postural trend very closely or extremely closely. However, three participants who did not mention the above aspects also demonstrated a very close or extremely close following of the expected trend. At the follow-up, eight participants demonstrated a whole-body awareness and mentioned several parts of their bodies, the head-neck-back relationship, or posture in a general sense. Of these eight participants, six of them followed the expected postural trend very closely or extremely closely. However, four participants who did not write about the abovementioned aspects also demonstrated a very close or extremely close following of the expected post-lesson pattern. It appears that having a broader focus on the body may result

in these participants following the expected postural trend more closely than those that do not. However, this is not always the case, so a general assumption cannot be made. There were participants who demonstrated a close following of the post-lesson pattern without mentioning or demonstrating a whole-body awareness, but it is possible that they thought about their whole bodies and did not write about it in their comments.

No studies have examined if there is a relationship between self-reports and objectively measured posture for pianists who have taken lessons in the AT. Studies in other fields that have explored the relationship between self-assessment and objective measurements look at the agreement between questionnaires completed by participants (i.e., self-assessment) and observational and direct measurements. Observational measurements include video analysis and posture analysis programs while direct measurements involve measurement tools such as goniometers, accelerometers, and electromyography (Barriera-Viruet *et al.* 2006; Spielholz *et al.* 2001). Studies that examined agreement between self-assessments and observational and direct measurements all found that self-assessments were the least accurate method of evaluation, with low agreement between questionnaires and direct measurement methods (Barriera-Viruet *et al.* 2006; Spielholz *et al.* 2001; Zare *et al.* 2017). One study (Balogh *et al.* 2004) found that people with musculoskeletal issues rated physical activity and physical exertion as higher than what was measured through direct methods. From these studies, it can be seen that participant perception does not necessarily agree with objectively measured variables. This present study came to a similar conclusion and showed that participants' perceptions of their own postures as well as their perceived application of the AT did not always equate to following the expected postural trend.

Study Limitations

A limitation of this study was the broad wording of the open question issued to pianists. More detailed questioning may show more definite findings. For example, participants who demonstrated an awareness of their whole bodies or did not focus on a few, specific parts of their bodies tended to show a clear change in posture, following the expected pre-lesson to post-lesson trend very closely. However, there were also participants who did not mention whole-body awareness or a general focus on many parts of their bodies who also exhibited a very close following of the expected postural trend after lessons. Another limitation of this study was the number of lessons given to participants. While ten lessons may help pianists develop a basic understanding of the Technique, it is still too few to allow students to develop a deeper knowledge and application of the AT. In addition, given the qualitative nature of this study, the findings cannot be generalised to a larger population.

Conclusion

To date, no previous study to our knowledge has compared the self-reported perceptions of pianists with objective measurements concerning their posture following lessons the AT. This present study is the first that has shown that pianists'

perceptions do not always agree with direct measurements of their posture. All participants demonstrated a change in posture from their pre-test measurements and most participants attempted to apply AT principles while playing, but the extent to which they followed the expected post-lesson trend varied. Some followed the predicted pre- to post-lesson pattern closely while others did not. Some felt that they played with good posture following lessons but did not demonstrate a very close following of the expected post-lesson trend while others who were not as confident about their posture exhibited a close following of the predicted pattern. Some participants felt they applied principles of the Technique often while their postural data did not show a close following of the expected trend while others who felt they applied principles only some of the time showed a close following of the pattern. Other cases revealed that some participants who felt they played with good posture or felt they applied principles of the Technique often showed a close following of the expected postural trend.

The results found in this study provide a starting point for exploring the relationship between participants' perceptions and posture following lessons in the AT. Future studies should be longitudinal and ask specific questions about the application of AT principles which may result in more definite relationships between pianists' perception of their posture, their application of the Technique, and their changes in posture.

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